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| 1. Title. | | | | |
| 2. Author's last name (see Author Index for complete name). Departments in regular issues are denoted by the following code: | | | | |
| N/T | News/Trends | | | |
| Scan | Scanning the Field for Ideas | | | |
| DIA | Design in Action | | | |
| DI | Design International | | | |
| CD | Conference Digest | | | |
| AD | Abstracts for Design | | | |
| 3. Date of issue, MACHINE DESIGN Reference Issues are denoted by the following code: | | | | |
| EC | Electric Controls (March 13) | | | |
| S | Seals (June 19) | | | |
| F&J | Fastening & Joining (Sept. 11) | | | |
| MD | Mechanical Drives (Dec. 18) | | | |
| 4. Page Number. | | | | |
| 5. Number of pages in article or editorial item. | | | | |

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V-Band Couplings	Goldberg	4/3	138	(4.0)
Locking Fasteners	(Chapter)			
	F&J 9/11	44	(4.0)	
Spring Clips	Seitz & Petrus	F&J 9/11	84	(6.0)
	F&J 9/11			
Sealing Fasteners	(Chapter)			
	F&J 9/11	66	(3.8)	

42, 43. Springs & Isolation Devices, Misc.

Designing Torsion Springs	Blandino	3/6	134	(6.0)
Flexing Fingers Pluck Curly Cards	Scan	8/21	112	(0.6)
Pneumatic Barge Coupling Tames Wave Effects	Scan	3/20	209	(0.6)
Bounce Chamber Levels Hydraulic-Shock Peaks	Scan	6/24	120	(0.7)
Bumper Banks on Torsion-Bar Deformation	Scan	7/10	120	(0.7)
Equalized Deflections Tune Shock-Mounted Panels	Scan	7/10	121	(1.0)
Rectangular-Wire Spring Design	Swieskowski	8/21	125	(3.0)
Flip-Flop Requires Alternate Keys	Scan	11/13	185	(0.5)
Matching Flats Trip Rocking Lock	Scan	11/27	129	(0.6)
Bowed Roll Twins Separate Silt Web	Scan	2/6	133	(0.5)
Golf-Cart Meter Calls Your Shots	Scan	7/10	124	(0.7)

Materials

51, 52. Ferrous, Nonferrous Metals

Materials	(Chapter)	F&J 9/11	4	(4.8)
Precipitation-Hardening Stainless Steels	White	1/23	142	(8.0)
Formability of Stainless Steels	Kopecki	2/6	149	(4.0)
Simplifying the Selection of Stainless Steels	Tyson	10/2	139	(3.0)
Trim Protects Car From Rust	N/T	11/13	18	(0.5)
Ultrasonic Testing of High-Strength Alloys	CD	3/6	164	(2.5)
Parts From Aluminum Powder	Khol	7/10	110	(5.0)
Copper Beats Out Steel In Saturn Injector	Scan	6/24	121	(0.8)
Designing With Titanium	CD	12/11	190	(1.5)
Hard Chromium	Hart	5/15	144	(4.0)

53, 54. Plastics, Rubber & Elastomer

Structural Behavior of Plastics	CD	7/10	152	(2.4)
Fortified Thermoplastics	Jones	11/13	205	(3.0)
What's Ahead for Stamped Plastics	Lavie	12/11	149	(5.0)
Mechanical Applications For Filled TFE	CD	1/9	162	(2.0)
New Developments in Contact Bearings	CD	6/24	134	(2.3)
Plastic Carb Keeps Its Cool	Scan	6/24	118	(0.7)
Designing With Titanium	CD	1/9	162	(2.0)
Conductive Plastics	Litant	10/16	168	(5.0)

55, 56. Joining Materials, Other Nonmetals

High-Temperature Structural Adhesives . . .	Petrie	5/15	175	(5.0)
Adhesive Bonding	Sharpe	F&J 9/11	119	(9.8)
Sealants	Stein	8/6/19	85	(10.0)
Welding and Welding Alloys	Rudy	F&J 9/11	104	(6.8)
Brazing and Brazing Alloys	Pattee	F&J 9/11	111	(4.6)
Soldering and Soldering Alloys	Smith & Boreina			
	F&J 9/11	116	(3.0)	
Fluorine Doesn't Bother Glassy Carbon . .	N/T	12/25	12	(0.5)

For Boeing's 747: 7-Ply Windshield 2 in. Thick	N/T	4/17	14	(0.5)
Designing With Felt	Becker	6/26	113	(13.0)
Polywater: It Freezes At -40 C. Boils At 500	N/T	8/7	14	(0.5)

57. Finishes, Coatings, Lubricants

Finishes and Coatings	(Chapter)			
	F&J 9/11	9	(3.0)	
'Umbrella' Found For Supersonic Rain	N/T	9/18	34	(0.5)
Vinyl Dispersion Coatings	Palkie	8/7	115	(3.0)
Teflon-S: Tough Skin for Slippery Parts	N/T	2/20	40	(2.0)
Nonspray Plastic Coatings	CD	2/6	160	(2.0)
Synthetic Lubricants	Fairbanks, Knapp & Lazarus	7/10	140	(9.0)
Dry-Lubricant Films	Kirkpatrick & Young	5/15	163	(3.0)
Bonding Dry-Film Lubricants	Paulus	12/25	68	(6.0)
Accelerating Lubricants Tests	CD	10/16	188	(2.2)
Sputtering Solid Lubricants	CD	12/25	86	(1.0)

58. Prefabricated Forms

Fiber-Metal Matrix Composites	Weeton	2/20	141	(16.0)
The Composite Aircraft	N/T	9/4	18	(1.0)
Joining Fiber-Reinforced Composites	CD	5/1	194	(2.4)
Composite Material Beef Up Chopper Blade	Scan	8/7	112	(0.5)
Joining Metal Tubing	(Article)	12/25	61	(4.0)
Jack-in-the-Box Mast Snaps Into Shape	Scan	12/11	154	(1.0)

Manufacturing Methods and Processes

61-63. Metals Casting, Shaping, Forming

Hollow Castings	Webb	3/6	130	(4.0)
Designing With Titanium	CD	12/11	190	(1.5)
Plastic Moldings—or Metal Die Castings?	Dreger	6/24	113	(4.0)
"Machined Forgings" Produced by New Metal-Forming Process	N/T	10/30	10	(0.7)
185-mm Projectile Cold Extruded from Steel Disc	N/T	9/18	18	(0.5)
Forged Powder Metal	Khol	4/3	142	(5.0)
Precision Controls Developed for P/M Parts	N/T	11/13	34	(0.7)
High Pressure Forming	Khol	1/9	124	(7.0)
Formability of Stainless Steels	Kopecki	2/6	149	(4.0)
Panel Joiner Zips Up Metal Roof Tin-Can Tight	Scan	5/29	110	(1.0)
What's Ahead for Stamped Plastic	Lavole	12/11	149	(5.0)

64-66. Metals Joining, Removal, Treating

Welding and Welding Alloys	Rudy	F&J 9/11	104	(6.8)
Joining Metal Tubing	(Article)	12/25	61	(4.0)
Trends in Fastening and Joining	Chapter F&J 9/11	3	(1.0)	
Specifying Welding Electrodes	Reid	2/6	146	(3.0)
Assembly-Line Shipyard Builds Warships Upside Down	N/T	4/3	12	(0.6)
Are-Welded Fasteners	Singleton	F&J 9/11	41	(3.0)
Resistance-Welded Fasteners	Schaft	F&J 9/11	38	(2.8)

Smallest Laser Weld Created On Production Line

Laser Welding	N/T	1/9	12	(0.5)
Explosive Welding	Lavole	2/20	136	(5.0)
Brazing Technique Solves Aluminum-Radiator Problems	Lavole	7/10	125	(5.0)
Brazing and Brazing Alloys	N/T	2/6	12	(0.5)
Soldering and Soldering Alloys	Pattee	F&J 9/11	111	(4.6)
Bonding Dry-Film Lubricants	Smith & Borcina	F&J 9/11	116	(3.0)
Adhesive Bonding	Paulus	12/25	68	(6.0)
Fastening Plastics to Nonplastics	Sharpe	F&J 9/11	119	(9.8)
Multidirectional Drill Motion Cuts Machining Time	CD	4/17	308	(2.6)
Wire-Screen Grinder Machine "Anything"	Scan	5/15	151	(0.8)
Electrochemical Machining	N/T	11/27	12	(0.5)
Flexibility Added to Electrochemical Machining	Aaron & Wolosewicz	12/11	160	(8.0)
	N/T	11/13	10	(0.5)

67-69. Metals Finishing, Plastics Processes

Finishes and Coatings	Chapter F&J	9/11	9	(3.0)
Designing Plated Plastic Parts	CD	2/20	178	(3.0)
Robot Speeds Production of Blast-Coated Parts	N/T	2/23	12	(0.7)
Plastic Moldings—or Metal Die Castings?	Dreger	6/24	113	(4.0)
"Impossible" Parts Produced by Rotational Molding	N/T	10/2	49	(1.7)
Automatic Assembly	Benes	3/20	191	(14.0)
Automatic Assembly	Benes	F&J 9/11	129	(3.0)

Design Theory and Techniques

71-73. Mechanics, Strength of Materials and Parts

International Mechanisms Group Established	N/T	10/30	42	(0.7)
Practical Rotor Dynamics—1: Geometric Properties of Rotors	Rasmussen	2/6	142	(4.0)
Practical Rotor Dynamics—Part 2: Load/Deflection Relationship	Rasmussen	2/20	157	(5.0)
Practical Rotor Dynamics—Part 3: Natural Frequencies & Critical Speeds	Rasmussen	3/6	158	(5.0)
Instrument Selection	Tustin	5/29	117	(9.0)
Avoiding Vibration Damage	Tustin	6/26	140	(4.0)
Prognosis With Plastic Models	Wright & Bannister	8/21	135	(5.0)
Missile Maker Minors In Music	N/T	4/17	10	(0.6)
Origins of Noise	Mitchell & Lynch	5/1	174	(5.0)
Fastener Evaluation	Brenner F&J	9/11	24	(2.6)
Stress and Deflection	Krupka & Mutyala	5/29	129	(4.0)
Basic Course in Failure Analysis	Lipson	10/16	146	(5.0)
Planning for Strength	Lipson	10/30	108	(5.0)
Microperformance of Metals	Weinstein	12/11	174	(8.0)
Basic Course in Failure Analysis—Failure Modes	Lipson	11/13	222	(4.0)
Damage-Tolerant Design	Osgood	10/30	91	(5.0)
Sagging Pressure Reveals a Giant Case of Fatigue	Scan	10/16	151	(1.0)
Why Fasteners Fail	CD	4/3	162	(2.0)
Selecting Materials to Resist Fatigue	CD	9/4	150	(1.7)
Laser Provides New Data on Impact	Lavole	3/20	212	(3.0)
Zero Wear	Bayer, Shailey & Wayson	1/9	142	(10.0)
Designing for Measurable Wear	Wayson	8/7	118	(10.0)
Adhesive and Abrasive Wear	Lipson	12/25	74	(4.0)
Pneumatic Line Losses	Wroten	12/11	182	(4.0)
Damage-Tolerant Design	Osgood	10/30	91	(5.0)
Joint Design	(Chapter) F&J 9/11	12	(2.0)	
Designing Tapered Beams	CD	10/2	144	(3.0)
Bending Fractures, Lesson 4	Lipson	11/27	140	(4.0)
Stress In Noncircular Shafts	Hassoun	6/24	132	(2.0)
Torsional Failures, Lesson 5	Lipson	12/11	186	(4.0)

74. Human Factors Engineering

Machines That Teach—Part 1	Klein	5/29	21	(8.0)
Feeding People On The Go	Spector	10/2	20	(10.0)
Common Sense Needs An Assist	Straus & Carlock	6/24	102	(4.0)
Human Factors Checked Out In DSSV Test	N/T	1/23	10	(0.8)
Human Factors Experts Probe For New Truck-Cab Efficiencies	N/T	3/6	48	(1.0)

Lifting Rubber Fingers Curl, Squeeze, and Hold

"Sea of Tranquility" for Earthlings With Ulcers	N/T	10/16	10	(0.8)
Off-The-Shelf Underwater Habitat	Scan	10/2	117	(1.0)
Elastic Dummy Will Eject From Jets	N/T	11/27	42	(1.0)
Product Safety	N/T	12/11	10	(0.5)
Pumped-Up Helmets Guard the Gridiron Greats	Wise	8/7	19	(15.0)
Nobody Knows About Household Accidents When Cars Crash, Bumper Absorbs Collision	(Article)	10/16	36	(2.0)
From Door Rammings, New Safety Standards?	N/T	6/26	10	(0.5)
Commentary Continues	N/T	9/4	10	(1.0)
Books on Tape and TV-Eye Backpack	N/T	10/16	14	(0.5)
Optimizing Working Environments	N/T	12/25	8	(1.0)
Squishy Shoe Lining Distributes Foot Forces	CD	5/1	14	(1.2)
	Scan	11/27	150	(1.7)
	Scan	12/11	156	(0.5)

75. Design Analysis and Synthesis

Organizing Design Problems	Burgess	11/27	120	(8.0)
3-D Graphics	Lavole	10/30	84	(7.0)
Component Status Chart	Wallenhorst	11/27	111	(3.0)
Product Planning by Computer	Correns	1/23	161	(2.0)
Systematic Subjectivity: Decision-Making With Utility Theory	Schermerhorn & Taft	2/6	122	(4.0)
Analog Simulator	Cook & Hultin	8/7	128	(4.0)
Radio-Control Models	Spector	11/13	20	(8.0)
Hobbies for Engineers: Think Games	Spector	12/25	28	(3.0)
Piggyback Models Mimic Spacecraft	Wood	1/9	40	(4.0)
Prognosis With Plastic Models	Wright & Bannister	8/21	135	(5.0)
Prognosis With Plastic Models	Wright & Bannister	9/4	136	(5.0)
Prognosis With Plastic Models	Wright & Bannister	10/2	128	(6.0)
Prognosis With Plastic Models	Wright & Bannister	10/16	178	(8.0)
Mountain Models: New Tool for Antenna Designers	N/T	6/26	18	(0.5)
Advanced Simulator Files Any Combat Mission Realistically	N/T	11/13	64	(0.7)
Elastic Dummy Will Eject From Jets	N/T	12/11	10	(0.5)
Computer Graphics: Part 1—The Engineer and the CRT Terminal	Dankowski & Lippert	4/17	226	(7.0)
Part 2—The Problems You Can Solve	Dankowski & Lippert	5/1	148	(8.0)
Computer Matches Designer, Methods Man As Working Team	Khol	3/6	127	(3.0)
From Computer to Microfilm—Nonstop	N/T	1/23	18	(3.0)
Use Your QA Capabilities	Kuhn	11/13	174	(6.0)
Estimating Service Life	CD	5/29	136	(2.0)

An Aerospace Industry Report on TPD Systematic Subjectivity: Minimizing Risk Factors in Design	Black Schermerhorn & Taft	3/20 177 (3.0)	
Design for Repairability	Wise	1/9 120 (4.0)	
		6/26 20 (7.0)	

76, 77. Basic Sciences, Experimental, Advanced Design

The Electric Brain	Khol	5/29 103 (8.0)	
Lunar Experiments Promise Rich Return	Wise	8/21 30 (4.0)	
Supercooled Atom-Smashing Electron Racetrack	Spector	3/6 42 (1.0)	
Supertrap for Invisible Particles	Spector	12/11 40 (4.0)	
Measuring Temperature	Lynnworth & Benes	11/13 190 (15.0)	
Liquid Crystals—A Film In Your Future?	Sproy	2/6 34 (6.0)	
Neutron Radiography	Lavole	2/6 138 (4.0)	
Pressure Erases Damage To Irradiated Metal	N/T	4/17 12 (0.5)	
"Sea of Tranquility" for Earthlings With Ulcers	Scan	10/2 117 (1.0)	
Oxygen Sniffer	Barnes	7/10 47 (2.0)	
Grafting Men Together Again	Barnes	8/21 20 (7.0)	
Epileptics May Get Attack-Warning Device	N/T	6/26 12 (0.6)	
Spacecraft Sterilizers Set Bacteria-Toasting Standards	N/T	2/20 18 (0.5)	
The Solid-State Cowbell	N/T	7/10 14 (1.3)	
Lifting Rubber Fingers Curl, Squeeze, and Hold	N/T	10/16 10 (0.8)	
New Treatment for Cancer: Ultrasonics, Chilling, and Poison	N/T	10/30 40 (0.5)	
Simple Pump Moves Human Blood	N/T	12/25 14 (0.6)	
Progress In Biomedical Engineering	CD	1/23 172 (3.0)	
What Good Is Holography	Aronson	1/23 26 (17.0)	
Optical Computers	Khol	8/21 117 (9.0)	
Holography: What the Germans Are Doing	Heumann	9/18 20 (3.0)	
Optoelectronics	Khol	10/16 156 (12.0)	
Optoelectronics, Part 2	Khol	11/13 208 (10.0)	

Gyro 'Platform' Added To Hand-Held Binoculars	N/T	1/9 10 (0.6)	
Holograms Shrink Computer Memories	N/T	6/26 10 (0.5)	
Foul-Weather Viewer Sees Through Fogs	N/T	1/9 14 (0.5)	
New Treatment for Cancer: Ultrasonics, Chilling, and Poison	N/T	10/30 40 (0.5)	
Ultrasonic Testing of High-Strength Alloys	CD	3/6 164 (2.5)	
X-15: Black Bullet That Paved a Path To the Moon	N/T	11/27 30 (5.0)	

78. Environmental Design

Weather: The Questionable Art of Alteration	Wood	3/20 33 (8.0)	
Keeping Patients Pure	Barnes	4/3 42 (3.0)	
Design to Control Corrosion	CD	8/7 136 (2.3)	
The Little Yellow Monster-Chasing Submarine	Spector	7/10 42 (1.0)	
Trip Guide To Apollo 10	Wise	5/15 36 (4.0)	
Twin Mariners Nearing Mars	Wise	6/24 20 (3.0)	
Elation, Apprehension Stir Scientific Community On Eve of Apollo 11	Wise	7/10 36 (4.0)	
The Next Big Step: Stations In Space	Wood	12/25 20 (6.0)	
Research Council Calls for More Spending on Satellites	N/T	3/6 18 (0.5)	
Factories In Orbit Won't Lack Work	N/T	4/17 44 (0.5)	
All-Purpose Space Station Planned for M-70s	N/T	5/15 15 (0.5)	
Best Window Opening for Outer-Planet Flybys	N/T	6/24 10 (0.5)	
Modular Space Station Could Grow Into 50-Man Base	N/T	11/13 12 (0.5)	
Astronauts Will Search for Surveyor	N/T	11/13 49 (1.0)	
Human Factors Checked Out In DSSV Test	N/T	1/23 10 (0.8)	
Boom In Bottom Bases	Barnes	2/6 18 (8.0)	
Assault On the Sea	Wise	4/17 20 (8.0)	
Emergency Air System Ready for Rescue Sub	N/T	5/15 10 (0.5)	
Ocean-Bottom Drillers Told to Stay At It Off-The-Shelf Underwater Habitat	N/T	11/27 28 (0.6)	
Weather	Wood	11/27 42 (1.0)	
		3/6 19 (14.0)	

Engineering Management, Personal

81. Engineering Department Operations

Plan Promotes Productivity	Kahle	10/2 102 (4.0)	
Need-To-Know for the Manager-In-Training	Karger & Murdick	6/24 98 (4.0)	
Lending Engineers	Lavole	5/29 92 (5.0)	
If You Manage Engineers	Rossnagol	8/21 107 (5.0)	
How To Move Up Without Dropping Out	Taylor	10/2 98 (4.0)	
What Causes Discontent?	(Article)	11/27 108 (3.0)	
The Failure of Functionalism	Brown	12/11 144 (2.0)	
Spark for Keeping a Project On Schedule	Brown	5/15 138 (6.0)	
Bridging the Communications Gap . . . From Your Side	D'Aprix	11/13 180 (3.0)	
Paper Work for Job Hunting	Carr	8/7 102 (2.0)	
Help Engineers Grow	Karger & Murdick	9/4 104 (4.0)	
What's Your JSQ?	Strauss	5/29 97 (5.0)	
Technical Employment Opportunities Show Large Gain	N/T	3/6 8 (0.7)	
Demand Reached New High for Class of '69	N/T	8/7 8 (0.7)	
Draft Opens Schools To Foreign Engineers	N/T	5/15 8 (0.8)	
Sharpest Rise in Engineers' Pay Posted In 1968	N/T	7/10 8 (1.0)	
Pay Hike OKed for Federal Engineers	N/T	10/2 8 (0.6)	

82-84. New Products, Drafting, Testing

Riot Control	Aronson	1/9 22 (9.0)	
Product Planning by Computer	Correns	1/23 161 (2.0)	
Ingredients for Successful Proposals	DeGeorge	4/3 122 (5.0)	
Before It's Too Late, Denovate	Spector	4/3 20 (7.0)	
Guidance System for Innovation	Spector	9/18 26 (5.0)	
R&D: Term for Accountants Only	N/T	6/24 8 (0.7)	
Project Task Teams	Stratton	6/26 102 (5.0)	
Eliminating Vanishing-Point Spread	Duncan	8/21 139 (1.0)	
Electric Photographs Developed Without Silver	N/T	1/9 12 (0.5)	
Supercamera Creates Precise Circuit Boards	N/T	10/16 12 (0.5)	
New Techniques in Joining	CD	8/21 144 (1.5)	
From Computer To Microfilm—Nonstop	N/T	1/23 18 (3.0)	
Just the Fax	Klein	2/20 20 (6.0)	
A New Engineering Facility	Goldberg	3/6 125 (2.0)	
Nondestructive Testing	Lavole	9/4 121 (15.0)	
Prognosis With Plastic Models	Wright & Bannister	8/21 135 (5.0)	
Tire Makers Devise Nondestructive Test	N/T	8/21 10 (0.5)	

Resistance Wire Cycles Test Load Application	Scan	1/9 133 (0.7)	
Test Chamber Simulates the Rigors of Re-entry	N/T	3/20 14 (1.3)	
Nine-Lane Track Tests New Tires	DI	11/27 48 (1.0)	
Accelerating Lubricants Tests	CD	10/16 188 (2.2)	

85. Technical Information

Government Information Sources	Clarke	10/30 96 (8.0)	
Ultrasonic Testing of High-Strength Alloys	CD	3/6 164 (2.5)	
Engineering Standards for Small Companies	Landau	10/16 140 (6.0)	
Read It Like It Is	Ebel	3/20 175 (3.0)	
Building 'Show' Biz Into Technical Talks	D'Aprix	4/3 127 (4.0)	
Speech-Making for the Unaccustomed Engineer	Prahalls	12/11 146 (3.0)	

87, 88. Personal, Professional, Outside Services

How the New Grads Measure Up	Chipman	9/18 227 (3.4)	
Help Engineers Grow	Karger & Murdick	9/4 104 (4.0)	
Noble Motives and Rich Rewards	Khol	9/18 178 (12.0)	
Technology's Privileged Offspring	Klein	9/18 198 (6.0)	
The New Social Involvement	Marlowe	9/18 218 (2.5)	
The Engineer As a Professional	Robbins	9/18 221 (3.8)	
The Engineer's Image	Ruder	9/18 225 (2.6)	
Living With Runaway Technology	Spector	9/18 190 (8.0)	
Revolution in Engineering Education	Tribus	9/18 215 (3.6)	
They'd Rather Stay Than Switch	(Article)	12/25 50 (4.0)	
Shape Up and Act Professional, Designers Are Told	N/T	8/7 42 (0.6)	
Forcing Ideas With Synectics	Raudsepp	10/16 134 (6.0)	
Ten Draftsmen Honored With Grand Design Awards	N/T	1/9 21 (1.0)	
Are Creative Engineers "More Equal" Than Others?	N/T	7/10 106 (4.0)	
Making Meetings Count	Zawacki	1/23 130 (3.0)	
Games Engineers Play	Raudsepp	2/20 130 (6.0)	
Promote Your Idea	Herzog	3/6 122 (3.0)	
Radio-Control Models	Spector	11/13 20 (8.0)	
International Mechanisms Group Established	N/T	10/30 42 (0.7)	
New Engineering Society Slow Getting Started	N/T	11/13 66 (0.7)	
Weacon Industrial Design Awards	N/T	8/21 36 (2.0)	

Specific Machines and Equipment

911. Ordnance

An Album of Design	(Article)	9/18	214	(11.0)
Riot Control	Aronson	1/9	22	(9.0)
Where Roads Don't Count	Aronson	5/1	36	(7.0)
European Fighter Aircraft	Aronson	10/16	44	(6.0)
New Ideas for Artillery	Aronson	12/11	26	(2.0)
Design for Battlefield Survival	Orgorkiewicz	11/13	36	(8.0)
New Armor Materials	Orgorkiewicz	11/27	36	(4.0)

912. Machinery

Mechanizing the Mails	Klein	3/20	20	(7.0)
Universal Power Units	Zimmerman	11/13	52	(3.0)
Safe Power Lawn Mower Throws Debris Forward	N/T	10/2	42	(1.0)
Truck's Load Slides on "Window Shades"	N/T	11/27	14	(1.3)
Air Knives Strip Sterilizer From Milk Wrapper	Scan	10/2	118	(0.5)

913. Electrical Machinery

Underwater Watchdogs	Boyd	5/29	31	(4.0)
Multiplexing Takes Off	Klein	6/26	34	(5.0)
The ABCs of CATV	Klein	11/27	20	(5.0)
On the Beat With the Electronic Cop	Spector	4/3	39	(2.0)
The Self-Cleaning Oven Derby	Spector	4/17	47	(4.0)
Feeding People On the Go	Spector	10/2	20	(10.0)
Research Hope to Shock-Proof Radar	N/T	3/6	14	(0.5)
Prototype Ready for Hang-On-Wall TV	N/T	6/24	10	(0.5)
Telephone Pictures Show What Computer Remembers	N/T	6/24	14	(0.5)
Laser Finds Job in Home-Entertainment System	N/T	10/30	12	(0.7)
Coming: The Trash Masher	N/T	11/27	45	(0.7)
Design Program Preview Home Appliances of the Future	N/T	12/11	32	(2.0)
Switch to D-C Leaves Turntable Wowless	Scan	10/2	119	(0.5)

914. Transportation

Foreign Car Sampler	Aronson	2/20	47	(4.0)
River-Boat Design	Aronson	7/10	20	(9.0)

The Zeppelins Are Coming (Again?)	Heumann	10/2	45	(3.0)
The Urban Mobility Hang-Up	Wise	4/17	36	(5.0)
Stripes, Scoops, and Spoilers—Signs of the Swinging '70s	Wise	9/4	20	(14.0)
Andy at Indy	Wood & Wise	5/15	20	(10.0)
Piggyback Models Mimic Spacecraft	Wood	1/9	40	(4.0)
The Automated Sky	Wood	10/30	19	(9.0)
Universal Power Units	Zimmerman	11/13	52	(3.0)
Escape Machines for All Seasons: ATVs	Zimmerman	12/11	20	(5.0)
People-Carrying Cylinders Pop Out of Pneumatic Tubes	N/T	1/9	14	(0.8)
Tampa Solves Terminal Sprawl	N/T	1/9	45	(3.0)
From Junk Cars, India's Tractors?	N/T	2/6	10	(0.7)
Go-Ahead Given on Big Surface-Effect Ship	N/T	2/20	10	(0.5)
Granatelli Goes Conventional, Almost	N/T	3/6	10	(1.7)
Frontier Runways Pose No Problems	N/T	4/3	18	(0.7)
Ford's Maverick: Bred and Built by Computer	N/T	4/3	31	(1.0)
World War II Airplanes Make a Mini-Comeback	N/T	6/24	44	(0.6)
Not a Warmed-Over F-111	N/T	7/10	44	(1.0)
Return of the Hornet	N/T	8/21	18	(1.0)
Build It, Then Fly It Away	N/T	9/4	12	(1.0)
Air Bag Passes Taxing Tests	N/T	9/18	10	(0.5)
Balloon Floats Downed Pilot Out of Enemy's Reach	N/T	9/18	25	(0.5)
Parentheses Propel Platform	N/T	10/30	34	(1.0)
Braking Study Seeks Best Runway	N/T	10/30	44	(0.7)
Steamer Assaults Speed Record	N/T	11/13	14	(1.3)
Three Aircraft Endurance Records Fall	N/T	12/25	10	(0.5)
Special Holst Serves "Harrier" VTOL	DI	5/29	48	(0.5)
New Fiat Has Front-Wheel Drive	DI	5/29	48	(0.5)
Frankfurt Auto Show Previewed	DI	8/21	41	(0.5)
VW '70	DI	9/18	35	(2.0)
Holden Hurricane	DI	10/2	34	(1.0)
Italian Luxury Car	DI	10/2	39	(0.5)
Opel Idea Car	DI	10/30	47	(0.5)
Four People-Movers: 30 by Capsule	DI	10/30	50	(0.7)
The Walking Truck	(Article)	4/17	32	(3.0)

915. Instruments

Photo Enlargements in a Minute	Spector	9/18	14	(1.3)
Scanning Electron Microscope	(Article)	6/24	106	(7.0)
Thermistored Nosepiece Makes Breathing Easier	Scan	11/13	188	(0.5)

Using the classification system provides nine major (one-digit) classifications, each of which has up to nine (two-digit) sub-classifications. These, in turn, are divided into ten (three-digit) indexing classifications.

Indexing classifications ending in 0 (General) are used to index material concerning several or all indexing classifications ending in 1 through 8. Classifications ending in 9 (Other) are used for material falling within the sub-classification but not within any of the items 1 through 8.

MACHINE DESIGN Subject Classification System

1-ELECTRICAL & ELECTRONIC

- 11 Motors**
 - 110 General
 - 111 Fractional (less than 1 hp)
 - 112 Ac integral horsepower
 - 113 Dc integral horsepower
 - 114 Universal (dc and ac)
 - 115 Multispeed
 - 116 Gearmotors
 - 117 Torque
 - 118 Definite and special purpose
 - 119 Other
- 12 Power Supplies**
 - 120 General
 - 121 Batteries (dry and wet)
 - 122 Dc generators, motor-generators
 - 123 Ac generators (alternators), motor-generators
 - 124 Converters, inverters
 - 125 Transformers
 - 126 Fuel cells, solar cells, photo cells
 - 127 Thermoelectric supplies
 - 128
 - 129 Other
- 13 Switches & Relays**
 - 130 General
 - 131 Mechanical (pushbutton, lever, rotary, mercury)
 - 132 Thermally operated (thermostats)
 - 133 Pressure operated
 - 134 Limit
 - 135 Proximity, photoelectric
 - 136 Stepping
 - 137 Relays, circuit breakers
 - 138 Motor starters (motor controls)
 - 139 Other (reed)
- 14 Instruments & Controls**
 - 140 General
 - 141 Sensing devices (transducers, thermocouples)
 - 142 Solenoids, electric actuators
 - 143 Timers, timing motors, delays
 - 144 Synchros
 - 145 Instrument motors
 - 146 Data recorders, readouts, indicators
 - 147 Meters, gages
 - 148 Servo motors, stepping motors
 - 149 Other
- 15 Circuit Components**
 - 150 General
 - 151 Resistors (rheostats, potentiometers)
 - 152 Capacitors
 - 153 Inductors
 - 154 Solid-State devices (diodes, transistors, SCR's, rectifiers, semiconductors, integrated circuits)
 - 155 Tubes
 - 156 Saturable reactors (magnetic amplifiers)
 - 157 Fuses
 - 158 Lasers, masers
 - 159 Other
- 16 Connectors & Wiring**
 - 160 General
 - 161 Rings, brushes, commutators
 - 162 Terminals, binding posts
 - 163 Contacts (buttons)
 - 164 Plugs, receptacles, connectors
 - 165 Wiring (cable, cord, coil, harness)
 - 166 Printed circuits, stitched circuits
 - 167
 - 168
 - 169 Other
- 17 Miscellaneous Components**
 - 170 General
 - 171 Electromagnets, magnets
 - 172 Chassis, control panels
 - 173 Insulation, encapsulation, shielding
 - 174 Cooling elements
 - 175 Lamps, lighting elements (fiber optics)
 - 176 Heaters, heating elements
 - 177 Electric clutches & brakes
 - 178
 - 179 Other
- 19 Systems & Assemblies**
 - 190 General
 - 191 Amplifiers, preamps
 - 192 Control systems (regulators, numerical control)
 - 193 Electronic computers
 - 194 Other electronic
 - 195 Adjustable-speed drives
 - 196 Servomechanisms
 - 197 Other electromechanical
 - 198 Packaging
 - 199 Other

2-FLUID POWER

- 21 Fluids**
 - 210 General
 - 211 Hydraulic fluids
 - 212 Coolants
 - 213
 - 214
 - 215
 - 216
 - 217
 - 218
 - 219 Other
- 22 Fluid Conditioners**
 - 220 General
 - 221 Fluid storage (pressure vessels)
 - 222 Filters, strainers
 - 223 Renovators
 - 224 Heat exchangers
 - 225 Coolers
 - 226 Heaters
 - 227 Driers
 - 228
 - 229 Others
- 23 Fluid Conductors**
 - 230 General
 - 231 Tubing (pressure)
 - 232 Hose
 - 233 Pipe
 - 234 Fittings
 - 235 Joints, couplings
 - 236
 - 237
 - 238
 - 239 Other
- 24 Linear Devices**
 - 240 General
 - 241 Cylinders
 - 242 Accumulators
 - 243 Intensifiers
 - 244 Actuators (bellows, diaphragms)
 - 245 Pumps (linear)
 - 246
 - 247
 - 248
 - 249 Other
- 25 Rotary Devices**
 - 250 General
 - 251 Pumps (rotary)
 - 252 Fluid Motors
 - 253 Air motors
 - 254 Compressors
- 255 Rotary actuators**
 - 256
 - 257
 - 258
 - 259 Other
- 26 Seals**
 - 260 General
 - 261 Materials seals (O-rings)
 - 262 Mechanical seals
 - 263 Gaskets
 - 264 Wiper rings
 - 265 Packings
 - 266
 - 267
 - 268
 - 269 Other
- 27 Valves**
 - 270 General
 - 271 Direction control
 - 272 Flow control
 - 273 Pressure control (relief)
 - 274 Servo valves
 - 275 Valve blocks (manifolds)
 - 276 Nozzles
 - 277
 - 278
 - 279 Other
- 28 Instruments & Controls**
 - 280 General
 - 281 Test stands
 - 282 Control panels
 - 283 Meters, gages
 - 284 Switches
 - 285 Transducers (to hydraulic)
 - 286 Regulators
 - 287 Fluidic devices
 - 288
 - 289 Other
- 29 Systems & Assemblies**
 - 290 General
 - 291 Industrial hydraulic & pneumatic systems
 - 292 Mobile, aircraft, marine
 - 293 Hydrodynamic drives
 - 294 Hydrostatic drives
 - 295 Vacuum
 - 296 Lubrication
 - 297 Hydraulic, pneumatic computers
 - 298
 - 299 Other

3-MECHANICAL

- 31 Power Sources**
 - 310 General
 - 311 Jet engines
 - 312 Internal-combustion engines
 - 313 Turbines
 - 314 Atomic, nuclear power
 - 315 Exotic fuel engines (rockets)
 - 316 Fuels, propellants
 - 317
 - 318
 - 319 Other
- 32 Constant-Speed Drives & Transmissions**
 - 320 General (speed reducers)
 - 321 Chain
 - 322 Belt
 - 323 Friction (ball, disc, wheel, cone)
 - 324 Gear
 - 325
 - 326
 - 327
 - 328
 - 329 Other
- 33 Adjustable-Speed Drives & Transmissions**
 - 330 General (speed reducers)
 - 331 Chain
 - 332 Belt
 - 333 Friction (ball, disc, wheel, cone)
 - 334 Gear
 - 335
 - 336
 - 338
 - 339 Other
- 34 Drive Components**
 - 340 General
 - 341 Transmission chain, cable
 - 342 Belts, belting
 - 343 Gears, gearing
 - 344 Sprockets
 - 345 Pulleys, sheaves
 - 346 Conveyor chain, conveyor cable
 - 347 Conveyor screws
 - 348
- 349 Other**
- 35 Rotational Components**
 - 350 General
 - 351 Antifriction bearings (ball, roller, needle)
 - 352 Sleeve bearings (gas, solid-lubricant), bushings
 - 353 Flexible couplings, universal joints, flexible shafts
 - 354 Torque converters, fluid couplings
 - 355 Shafts, axles, splines, pinions, crank-shafts
 - 356 Clutches, brakes
 - 357 Fans, blowers
 - 358
 - 359 Other
- 36 Mechanisms**
 - 360 General
 - 361 Cams
 - 362 Linkages
 - 363 Intermittent-motion (periodic-motion, indexing)
 - 364 Three dimensional
 - 365 Motion converters (leadscrews)
 - 366 Spring motors
 - 367
 - 368
 - 369 Other
- 37 Controls**
 - 370 General
 - 371 Push-pull
 - 372 Transducers (to mechanical)
 - 373 Gyros, gyroscopes
 - 374 Counters
 - 375
 - 376
 - 377
 - 378
 - 379 Other
- 39 Systems**
 - 390 General

4-ASSEMBLY COMPONENTS

- 41 Fasteners**
 - 410 General
 - 411 Inserts
 - 412 Nuts
 - 413 Pins
 - 414 Quick operating (panel-type, latches)
 - 415 Retaining rings, keys, collars
 - 416 Rivets
 - 417 Screws, bolts, studs
 - 418 Washers, grommets, eyelets
 - 419 Other (spring clips, clamps)
- 42 Springs & Isolation Devices**
 - 420 General
 - 421 Fluid & air springs
 - 422 Helical-wire springs
 - 423 Leaf springs
 - 424 Vibration isolators, mounts
 - 425 Hydraulic-damping devices (shock absorbers, snubbers)
- 426 Mechanical-damping devices**
 - 427
 - 428
 - 429 Other
- 43 Miscellaneous**
 - 430 General
 - 431 Locks
 - 432 Nameplates, labels
 - 433 Dials, knobs, handles
 - 434 Shims
 - 435 Enclosures
 - 436 Wheels, tires, rollers, casters
 - 437 Slides
 - 438 Hinges, brackets
 - 439 Other
- 49 General**
 - 490 General

5-MATERIALS

- 51 Ferrous Metals**
 - 510 General
 - 511 Cast iron, malleable iron, cast carbon, alloy steels
 - 512 Wrought carbon, alloy steels
 - 513 Free-machining steels
 - 514 Stainless steels, high alloys, high-temperature steels
 - 515 Specialty steels (tool, die, electrical)
 - 516
 - 517
 - 518
 - 519 Other
- 52 Nonferrous Metals**
 - 520 General
 - 521 Aluminum
 - 522 Copper, Brass, Bronze
 - 523 Magnesium
 - 524 Nickel
 - 525 Titanium
 - 526 Zinc
 - 527 Refractory metals (tungsten, tantalum, molybdenum, columbium)
 - 528 Precious metals
 - 529 Other
- 53 Plastics**
 - 530 General
 - 531 Thermoplastic plastics (nylon, Teflon)
 - 532 Thermosetting plastics (epoxy, phenolic, filled silicones, rigid urethanes)
- 533 Laminated plastics, vulcanized fiber**
 - 534 Reinforced, filled plastics
 - 535
 - 536
 - 537
 - 538
 - 539 Other
- 54 Rubber & Elastomer**
 - 540 General
 - 541 Natural rubber
 - 542 Synthetic rubber
 - 543 Elastomeric plastics (flexible silicones & urethanes)
 - 544 Hard rubber
 - 545
 - 546
 - 547
 - 548
 - 549 Other
- 55 Joining Materials**
 - 550 General
 - 551 Adhesives, sealants
 - 552 Welding rods
 - 553 Brazing, soldering alloys
 - 554
 - 555
 - 556
 - 557
 - 558
 - 559 Other

5-MATERIALS (continued)

- 56 Other Nonmetals
- 560 General
- 561 Carbon, graphite
- 562 Glass, ceramics
- 563 Refractory materials, mica
- 564 Carbides, cermets
- 565 Mineral & synthetic fibers, felt
- 566 Insulating materials (thermal)
- 567 Wood, cork, composition board, paper
- 568 Chemicals
- 569 Other
- 57 Finishes, Coatings & Lubricants
- 570 General
- 571 Metallic coatings
- 572 Chemical coatings, electrochemical coatings
- 573 Organic finishes (lacquers, synthetic enamels), paints, varnishes
- 574 Porcelain enamels, vitreous coatings
- 575 Plastic coatings

6-MANUFACTURING PROCESSES

- 61 Metal Casting
- 610 General
- 611 Sand
- 612 Shell mold
- 613 Permanent mold
- 614 Centrifugal
- 615 Investment
- 616 Die
- 617
- 618
- 619 Other
- 62 Metal Shaping
- 620 General
- 621 Forging
- 622 Extrusion, impact extrusion
- 623 Heading, upsetting
- 624 Thread, form rolling
- 625 Powder metallurgy
- 626
- 627
- 628
- 629 Other
- 63 Metal Forming
- 630 General
- 631 Sheet, plate forming
- 632 Stamping, drawing
- 633 High-velocity forming (explosive forming)
- 634 Spinning
- 635 Roll forming
- 636 Tube forming
- 637 Wire forming
- 638
- 639 Other
- 64 Metal Joining
- 640 General
- 641 Arc welding
- 642 Gas welding
- 643 Resistance welding
- 644 High-energy welding (plasma, electron beam, explosive bonding)
- 645 Flame cutting
- 646 Brazing
- 647 Soldering
- 648 Adhesive joining, bonding
- 649 Other
- 65 Metal Removal
- 650 General
- 576 Lubricating materials
- 577
- 578
- 579 Other
- 58 Prefabricated Forms
- 580 General
- 581 Film, tape, sheet, foil
- 582 Wire, wire cloth, wire rope, cable
- 583 Patterned, perforated, expanded metals
- 584 Laminates (other than laminated plastic)
- 585 Composite materials
- 586 Structures (honeycomb, foam, sandwich)
- 587 Structural shapes (tubing, channels)
- 588 Balls
- 589 Other
- 59 General
- 590 General
- 651 Planing, broaching
- 652 Lathe, screw machining
- 653 Milling, hobbing, gear shaping
- 654 Drilling, boring
- 655 Grinding, abrasive machining
- 656 Honing, lapping, polishing
- 657 High-energy machining (spark, laser)
- 658
- 659 Other
- 66 Metal Treating
- 660 General
- 661 Heat treating
- 662 Surface treating (carburizing, nitriding)
- 663 Shot peening, surface working
- 664 Chemical milling, etching
- 665
- 666
- 667
- 668
- 669 Other
- 67 Finishing
- 670 General
- 671 Chemical, solvent cleaning
- 672 Mechanical finishing
- 673 Conversion coating (anodizing) electro-polishing
- 674 Electroplating, vacuum metallizing
- 675 Metal spraying (flame spraying), hard facing
- 676 Painting
- 677
- 678
- 679 Other
- 68 Plastics & Rubber Processes
- 680 General
- 681 Molding
- 682 Extrusion
- 683 Sheet forming
- 684 Laminating
- 685 Casting
- 686 Stamping, machining, fabricating, forming
- 687 Calendering, coating
- 688 Encapsulation
- 689 Other (filament winding)
- 69 General
- 690 General

7-DESIGN THEORY & TECHNIQUES

- 71 Mechanics
- 710 General
- 711 Statics (at rest)
- 712 Dynamics (force to create motion)
- 713 Kinematics (motion in abstract)
- 714 Vibration
- 715 Shock
- 716 Noise, sound, music
- 717
- 718
- 719 Other
- 72 Strength of Materials
- 720 General
- 721 Elastic theory
- 722 Plastic theory
- 723 Fatigue, endurance
- 724 Creep
- 725 Impact stress
- 726 Thermal stress
- 727 Friction
- 728
- 729 Other
- 73 Strength of Parts
- 730 General
- 731 Tension, compression
- 732 Bending
- 733 Shear, torsion
- 734 Surface contact stress
- 735 Plates
- 736 Cylinders, columns
- 737 Rotating discs
- 738
- 739 Other
- 74 Human-Factors Engineering
- 740 General
- 741 Styling
- 742 Color
- 743 Safety
- 744 Illumination
- 745 Human limitations
- 746
- 747
- 748
- 749 Other

7-DESIGN THEORY & TECHNIQUES (continued)

- 75 Design Analysis & Synthesis
- 750 General
- 751 Mathematical methods (statistics)
- 752 Graphical techniques
- 753 Analogs, models
- 754 Computer techniques
- 755 Reliability, quality control
- 756 Dimensioning (tolerances)
- 757
- 758
- 759 Other
- 76 Basic Sciences & Fields
- 760 General
- 761 Physics
- 762 Chemistry
- 763 Thermal (cryogenics, heat transfer)
- 764 Radiation
- 765 Biosciences
- 766 Optics (photography)
- 767 Ultrasonics
- 768
- 769 Other
- 77 Experimental Design
- 770 General
- 771 Prototypes, breadboards
- 772 Testing (stress analysis)
- 773
- 774
- 775
- 776
- 777
- 778
- 779 Other
- 78 Environmental Design
- 780 General
- 781 Corrosion, rust
- 782 Mold, fungus
- 783 Outer space
- 784 Under sea
- 785
- 786
- 787
- 788
- 789 Other
- 79 General
- 790 General

8-ENGINEERING MANAGEMENT & OPERATION

- 81 Engineering Department Operations
- 810 General
- 811 Structure, organization
- 812 Costs
- 813 Programing, planning
- 814 Personnel policies
- 815 Recruiting, evaluation, training
- 816 Managerial talent
- 817 Compensation
- 818
- 819 Other
- 82 New Product Development
- 820 General
- 83 Drafting & Reproduction
- 830 General
- 831 Management, control systems
- 832 Drafting practices, techniques
- 833 Technical illustration
- 834 Drafting equipment
- 835 Reproduction equipment, systems
- 836 Furniture
- 837
- 838
- 839 Other
- 84 Laboratory & Testing
- 840 General
- 85 Technical Information
- 850 General
- 851 Engineering libraries, files
- 852 Information classification, retrieval
- 853 Specifications, standards
- 854 Report writing, articles, papers, oral
- 855 Part numbering
- 856 Engineering records
- 857
- 858
- 859 Other
- 86 Patents & Patent Law
- 860 General
- 87 Personal & Professional
- 870 General
- 871 Creativity, inventiveness
- 872 Meetings, shows
- 873 Other personal
- 874 Societies
- 875 Professional licensing
- 876 Unions
- 877
- 878
- 879 Other professional
- 88 Outside Services
- 880 General
- 881 Engineering design services
- 882 Industrial design services
- 883
- 884
- 885
- 886
- 887
- 888
- 889 Other
- 89 General
- 890 General

9-MISCELLANEOUS

- 91 Complete Machines
- 910 General
- 911 Ordnance (tanks, missiles, rockets, ammunition, SIC 19)
- 912 Machinery (agricultural, construction, machine tools, office machinery, materials handling, SIC 35)
- 913 Electrical machinery (communications, radio radar, TV, appliances, X ray, SIC 36)
- 914 Transportation (automotive, aircraft, ships, railroad, SIC 37)
- 915 Instruments (medical, dental, photographic, watches, SIC 38)
- 916 Fabricated metal products (hand tools, etc., SIC 34)
- 917
- 918
- 919 Other
- 99 Unclassified
- 990 General
- (includes pages such as Editorials, "Back Talk," Covers, Contents Pages, etc.)

